

## Iodine Supplementation: A Double Edged Sword

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### Introduction

In 1811, Courtois serendipitously discovered iodine, when he added sulfuric acid to seaweed in order to extract ammonium nitrate, a substance used to manufacture gun powder for Napoleon's army. This chemical reaction led to the release and subsequent re-crystallization of a violet vapor [1]. In 1895, Baumann found the presence of this element in the thyroid gland and in 1917; Marine and Kimball linked the development of a goiter to iodine deficiency. Since then, iodine has been identified as being essential to the production of thyroid hormone and hence, essential for mammalian life. Due to the recognition of the morbidity and mortality associated with iodine deficiency, the latter half of the 20th century saw the term "iodine deficiency disorders" being coined, as well as aggressive measures to increase dietary iodine supplementation [2]. Recently, there has been an increasing emphasis in the field of alternative medicine to increase the oral intake of iodine. Some proponents suggest that it can be safely ingested in concentrations 100,000 times the recommended daily allowance (RDA) [3]. However, clinical data and physiological mechanisms, such as the Jod-Basedow phenomenon or the Wolff-Chaikoff effect, demonstrate that excessive exogenous iodine can cause thyroid dysfunction in the form of hyperthyroidism or hypothyroidism [4].

Iodine is integral to the production of thyroid hormone and consequentially essential for the existence of life. Research as far back as the early 1900s demonstrated that thyroid goiters can be prevented by iodine supplementation. In 1980, the World Health Organization estimated that 20-60% of the world's population were iodine deficient. Since the 1990s, national nutrition strategies/public health programs have focused on eliminating iodine deficiency and "iodine deficiency disorders." Common foods are estimated to provide 3-80µg of iodine per serving, whereas a diet high in seaweed gives 50-80mg per day. Many nations also supplement diet with strategies such as the use of iodized salt, the addition of iodine to fertilizers and livestock feed, as well as the use of iodine in irrigation water [2]. In the United States of America (US), the iodine content in iodized salt is 77mg iodine/g salt [4].

While focusing on prevention, one must take into account the recommended daily allowance of iodine and the potential risks of over supplementation. Guidelines established by the US Institute of Medicine recommend a daily iodine intake of 150µg per day, in a non-lactating, non-pregnant adult. The tolerable upper limit of intake is 1100µg per day. The European Commission/Scientific Committee on Food sets an upper limit of 600µg per day. Again, the risk of morbidity associated with over supplementation does exist. Historically, rat experiments by Wolf and Chaikoff demonstrated a brief inhibition of thyroid synthesis following a large intra-peritoneal iodine load. On the other hand, Basedow identified a risk of hyperthyroidism following an iodine load, in the setting of autoregulatory dysfunction, giving rise to the Jod-Basedow phenomenon [4]. Longitudinal data from Denmark

after the initiation of iodized salt indicates that there is a potential for individuals to develop either hypothyroidism or hyperthyroidism [5]. In 2012, a review by Leung and Braverman highlighted that although excess iodine may be tolerated, iodine induced thyroid dysfunction can occur in susceptible individuals or in individuals with underlying thyroid disease [4].

During the last decade, there has been a drive in the field of alternative medicine to increase iodine supplementation, as current recommended levels of intake are suboptimal [6]. Medical iodophobia is used as a term to describe a fear in the realm of conventional medicine to give inorganic, non-radioactive iodine/iodide at doses equaling 12.5-37.5mg a day. The term orthiodosupplementation has been suggested by some proponents of this dose. This concept of not only deals with uptake by the thyroid gland, but also with the postulated requirement of the entire body. Accordingly, the requirement for the human body is said to be 100x the current recommended daily allowance of iodine [3]. Further support for safety when prescribing high doses comes from studies such as those carried out by Ghent et al. Here, patients without pre-existing thyroid disease were given 3-6mg of molecular iodine over 5 years to treat fibrocystic breast disease. No thyroid dysfunction was reported [7]. In the Iodine Project, Abraham supplemented over 4,000 patients with doses ranging from 12.5 to 50mg a day. Patients with diabetes mellitus received 100mg a day. A reversal of fibrocystic breast disease, reduction in the insulin requirement of patients with diabetes, and resolution of symptoms of conditions such as fibromyalgia was reported. Less than 5% of subjects developed hyper- or hypothyroidism [8]. At present, preparations such as Iodoral<sup>®</sup> (by Optimox Corp.) contain iodine/iodide (12.5mg/tablet) [6].

There clearly exists a dichotomy between the practitioners of allopathic medicine and the practitioners of alternative medicine, with regards to iodine supplementation. While the debate continues, an increasing number of patients are using complementary and alternative medicine (CAM) as an adjunct to their medical management. In 2007, 38% of adults in the US had used CAM therapy in a 12 month period [9]. Clearly, there is a role for both these avenues, in the holistic treatment of an individual. However, whilst the potential for CAM therapy exists, more study is needed to truly ascertain safe and appropriate dosing. Health care must be delivered through a multidisciplinary approach that involves a collaborate effort between allopathic and complementary/alternative medicine health professionals. This will help to reduce adverse drug reactions, and provide therapy that is both safe and effective.

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